WHAT IS CLAIMED IS:

1. A method of controlling the transport of magnetic beads between a position X and position Y along a path P, the method comprising:

applying a series of N magnetic fields having magnetic field gradients different from 0 within a predetermined proximity to said magnetic beads; and

generating each of said N magnetic fields by a single current-carrying structure, wherein each of said current carrying structure has a non-constant charge current density.

2. The method according to Claim 1, wherein said magnetic beads are configured to attach to a biological or chemical specimen.

3. The method according to Claim 1, wherein each of said N magnetic fields spreads over an area having dimensions of the order of 5 to 50 times the dimension of the bead or group of beads.

4. The method according to Claim 1, wherein applying each of said N magnetic fields is sustained for a duration that is long enough to move said magnetic bead to a location of its substantially lowest energy in said local magnetic field (L_E_min).

5. The method according to Claim 1, wherein said current carrying structure is disposed on a substrate by microelectronic process technology.

6. The method according to Claim 1, wherein said series of N magnetic fields are generated by M current carrying structures.

7. The method according to Claim 6, wherein said non-constant charge current density is generated by varying the shape of the cross-section of said current carrying structure.

8. The method according to Claim 7, wherein said non-constant charge current density is generated by varying the cross-sectional surface area of said current carrying structure.

9. The method according to Claim 7, wherein said non-constant charge current density is generated by varying the width of said current-carrying structure along the current direction.

10. The method according to Claim 1, further comprising defining a path by a series of N locations of substantially lowest energy (L_E_min {i}) of said magnetic beads corresponding to said series of N magnetic fields.

11. The method according to Claim 8, wherein M is 2 and where said local magnetic fields are generated alternately in each of the current-carrying structures.

12. The method according to Claim 11, wherein said current-carrying structures are characterized by a periodic shape, formed by a repetitive structural element.

13. The method according to Claim 12, wherein said structural element is characterized by an asymmetrical mirror with respect to an axis that is orthogonal to the direction of the current.

14. The method according to Claim 8, wherein said cross-sectional surface area decreases along the direction of the current, from one side of said structural elements to another.

15. The method according to Claim 11, wherein said M current-carrying structures are isometric.

16. The method according to Claim 15, wherein said current-carrying structures are stacked on top of each other, and each is shifted by a distance different from 0 along the current direction.

17. The method according to Claim 16, wherein said current carrying structures are positioned next to each other such that their respective current directions are substantially parallel and wherein each structure is shifted from the other by a distance different from 0 along the parallel direction.

18. The method according to Claim 16, wherein said distance equals half the length of said basic structure element.

19. The Method according to Claim 12, wherein said structural element is configured to be as a shark-fin or triangular in shape.

20. The method according to Claim 10, further comprising isolating, aligning and sequencing said magnetic beads by the spatial resolution of said current conducting structures and thus path compared to the bead size.

21. The method according to Claim 2, further comprising detecting and transporting said biological or chemical specimen.

22. A device for controlling transport of magnetic beads between a position X and a position Y along a path P, the device comprising:

a plurality of current-carrying structures having a non-constant charge current density when conducting a current, said current-carrying structures being substantially electrically isolated from each other;

a current source configured to alternately provide a current to each of said current-carrying structures to generate a series of successive field minima of magnetic fields to which the beads are attracted forming the path P between the position X and the position Y, wherein said current-carrying structures are positioned sufficiently close together to generate said series of subsequent field minima of magnetic fields.

23. The device of Claim 22, wherein the current source comprises a switchable current supply connected to said current-conducting structures, said switchable current supply being configured to switch current supply between said current carrying structures at switching frequency.

24. The device according to Claim 22, wherein said current-carrying structures are disposed on a substrate by microelectronic process technology.

25. The device according to Claim 22, wherein said current-carrying structures vary in shape of their cross-section relative to the direction of current flow.

26. The device according to Claim 26, wherein the cross-section surface area of said current-carrying structure varies along the direction of current flow.

27. The device according to Claim 22, wherein said non-constant charge current density is generated by varying the width of said current carrying-structure along the direction current flow.

28. The device according to Claim 22, whereby said current carrying-structures characterized by a periodic shape, formed by a repetitive structural element.

29. The device according to Claim 27, wherein said structural element is characterized by an asymmetric mirror with respect to an axis that is orthogonal to the direction of current flow.

30. The device according to Claim 27, whereby the cross-section surface area decreases along the direction of the current, from one side of said structural elements to another.

31. The device according to Claim 22, wherein said current-carrying structures are isometric

32. The device according to Claim 22, wherein the plurality of current-carrying structures consists of 2 current-carrying structures.

33. The device according to Claim 31, wherein said current-carrying structures are of substantially the same shape and size, and are stacked on top of each other, each being shifted by a distance different from 0 along the direction of current flow, such that currents are applied alternately to said current-carrying structures to generate successive magnetic field minima along and towards the end of said path P.

34. The device according to Claim 31 wherein the current-carrying structures are of substantially the same shape and size, and are positioned next to each other such that their respective current directions are parallel, and wherein both structures are shifted by a distance different from 0 along the parallel direction.

35. The device according to Claim 33, whereby the shifted distance equals half the length of the structural element.

36. The device according to Claim 28, whereby said structural element is sharkfin-like or triangular-like or sawtooth like.

37. The method according to Claim 1, further comprising:
   analyzing a biospecimen by means of biochips;
   transporting said biospecimen to a specific location on said biochip; and
   transporting said biospecimen away from said specific location.

38. The method according to Claim 36, further comprising performing an analysis of a biochemical on said biospecimen on said specific location.

39. The device according to Claim 22, wherein the device is implemented in a biochip configured to transport, separate, and align beads and corresponding biospecimen.